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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
|-----------------|-------------|----------------------|---------------------|------------------|
| 10/711,239 | 09/03/2004 | Hari Hariharan | GEMS8081.228 | 5238 |

27061 7590 11/17/2006

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EXAMINER

VAUGHN, MEGANN E

ART UNIT PAPER NUMBER

2859

DATE MAILED: 11/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|--------------------------------------|---|--|
| Office Action Summary | Application No. 10/711,239 | Applicant(s) HARIHARAN ET AL. | |
| | Examiner Megann E. Vaughn | Art Unit 2859 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 16 October 2006.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-21 is/are pending in the application.
- 4a) Of the above claim(s) 9-20 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-8, 21 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
 Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
 Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

1. Upon further consideration, the finality of the previous office action was withdrawn and thus the amendment filed on 10/16/2006 including the listing of claims has been entered. Furthermore, since the intent of applicant is clear with respect to claim 1, the examiner has considered the status identifier of claim 1 to be –currently amended—instead of “original”. Accordingly claims 1-8 and 21 will be further treated on the merits. Claims 9-20 are withdrawn as directed to non-elected invention as stated in the Non-Final Rejection office action dated 3/22/2006.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claims 1, 2, and 21 are rejected under 35 U.S.C. 102(b) as being anticipated by LeRoux et al (US 5345176).

Regarding claim 1, LeRoux et al discloses in figure 1, an MRI apparatus comprising: a magnetic resonance imaging (MRI) system having a plurality of gradient coils (136) positioned about a bore of a magnet (146) to impress a polarizing magnetic field and an RF transceiver system (122) and an RF switch controlled by a pulse module (120) to transmit RF signals to an RF coil assembly (138) to acquire MR images; and

a computer (100) programmed to determine, in real-time, a respective flip angle for each data acquisition pulse of a pulse sequence (column 9, lines 1-10) for multi-echo acquisition of MR data matched to a given target tissue and a given scan prescription to reduce ringing artifacts from amplitude decay of the multi-echo acquisition (column 1, lines 13-18).

Regarding claim 2, LeRoux et al discloses the computer is further programmed to determine the respective flip angle for each data acquisition pulse to maintain cumulative RF deposition during data acquisition within a prescribed level (column 9, lines 39-41).

Regarding claim 21, LeRoux et al discloses in figure 1, an MRI apparatus comprising: a magnetic resonance imaging (MRI) system having a plurality of gradient coils (136) positioned about a bore of a magnet (146) to impress a polarizing magnetic field and an RF transceiver system (122) and an RF switch controlled by a pulse module (120) to transmit RF signals to an RF coil assembly (138) to acquire MR images; and

a computer (100) programmed to determine, in real-time, a respective flip angle for each data acquisition pulse of a pulse sequence (column 9, lines 1-10) for multi-echo acquisition of MR data matched to a given target tissue and a given scan prescription to reduce ringing artifacts from amplitude decay of the multi-echo acquisition (column 1, lines 13-18),

wherein the computer is further programmed to determine the respective flip angle from a selection of one of a number of stored polynomial expressions of available flip angle trains, the selected polynomial expression being most optimal of the number of stored polynomial expressions for the given target tissue and the given scan prescription (column 8, lines 30-60).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 3-5 and 7 are rejected under 35 U.S.C. 103(a) as being unpatentable over LeRoux et al (US 5345176) in view of Alsop's The Sensitivity of Low Flip Angle RARE Imaging.

Regarding claim 3, LeRoux discloses that the computer is further programmed to determine the respective flip angle from a selection of one of a number of stored polynomial expressions of available flip angle trains, the selected polynomial expression being most optimal of the number of stored polynomial expressions for the given target tissue and the given scan prescription (column 8, lines 30-60).

Regarding claim 7, LeRoux et al discloses the MRI apparatus and method wherein the computer is further programmed to determine the respective flip angle for each data acquisition pulse (column 9, 1-12).

LeRoux et al does not disclose specifically that the flip angles are determined based on T1 and T2 characteristics of the given tissue.

Alsop discloses that the relationship between T1, T2, flip angle, and echo amplitude (page 179). Therefore it would have been obvious to a person having ordinary skill in the art at the time that the invention was made to use the equation using T1 and T2 values to calculate the flip angle because it makes the calculation more specific to the type of tissue being imaged due to the fact that T1 and T2 are different for every tissue.

Regarding to claim 4, LeRoux discloses that the computer is further programmed to determine a most optimal polynomial expression from a target amplitude desired for a majority of echoes of the multi-echo acquisition (column 8, lines 61-63).

Regarding claim 5, LeRoux discloses that the computer is further programmed to determine a flip angle train for the pulse sequence from the number of stored polynomial expressions (column 8, lines 30-60) that will provide a less noisy image (column 1, lines 13-18) of the target tissue.

6. Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over LeRoux et al (US 5345176) in view of Loncar et al (US 6252400).

LeRoux et al discloses the MRI apparatus and computer programmed to determine the flip angle as discussed above in paragraph 5.

LeRoux et al does not specify the magnetic field strength used.

Loncar et al discloses an MRI apparatus with a magnetic field strength of 1.5 Tesla. Therefore it would have been obvious to a person having ordinary skill in the art at the time that the invention was made to use a magnetic field of 1.5 Tesla as taught by Loncar et al because 1.5 T is a common magnetic field setting in MRI and at 1.5 T hydrogen dipoles have a well known resonance strength of approximately 64 MHz, and because of the abundance of hydrogen and its strong signal most typical MRI apparatuses are tuned to the resonant frequency for hydrogen (column 1, lines 47-53).

7. Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over LeRoux et al (US 5345176) in view of Stuber et al (US 6230039).

With respect to claim 8, LeRoux et al discloses the MRI apparatus wherein the computer is programmed to acquire data with a fast spin echo pulse sequence (column 1, lines 13-18).

LeRoux et al does not disclose specifically that his apparatus can acquire 2D or 3D data.

Stuber et al discloses the methods and the software wherein the computer is programmed to acquire 2D or 3D MR data (column 3, lines 34-36). Therefore it would have been obvious to a person having ordinary skill in the art the time that the invention was made to program the computer to acquire both 2D and 3D images in order to enable the user to either use a single stepped gradient along a single direction or two stepped gradients along two orthogonal directions as taught by Stuber et al (column 3, lines 33-41), to acquire the best image (2D or 3D) for the specific tissue.

Response to Arguments

8. Applicant's arguments filed 10/16/2006 have been fully considered but they are not persuasive. Original independent claim 1 and independent claim 21 were rejected under 35 USC 102(b) as being unpatentable over LeRoux et al in the non-final rejection dated 3/22/2006 and the final rejection dated 8/16/2006 respectively, and the rejections still stand. Applicant's after final remarks filed 10/16/2006 argue on page 7 that LeRoux et al fails to disclose that the pulse sequence is "matched to a given target tissue", but LeRoux et al discloses in column 7, lines 23-36 that the pulse sequence is chosen for specific tissue types, i.e. the pulse sequence is matched up to the knee joint muscle tissue. Applicant also argues on page 7 that LeRoux et al fails to disclose a given scan prescription to reduce ringing artifacts from amplitude decay, but LeRoux et al discloses a method for stabilizing the echo signal output (column 8, lines 21-26), and therefore the amplitude decay, which leads to the reduction of image artifacts (column 1, 15-18).

Conclusion

9. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the


shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Megann E. Vaughn whose telephone number is 571-272-8927. The examiner can normally be reached on 8 am- 5 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Diego Gutierrez can be reached on 571-272-2245. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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11/7/2006


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